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ABSTRACT

This is the second of four guidebooks on developing computational skills using the "stretcher and shrinker" approach developed by UICSM. Approximation, inverses, equations, factoring, and rearrangement are covered. Overall goals for the course, performance objectives, teaching suggestions, and a suggested time schedule are included. Sixteen references for enrichment and practice activities are listed. For other booklets in this set, see SE 014 883 and SE 014 884. (DT)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

DOUBLE-S NUMBER THEORY

5211.09
5212.09

MATHEMATICS

DIVISION OF INSTRUCTION • 1971

ED 067292

QUINMESTER MATHEMATICS

COURSE OF STUDY

FOR

DOUBLE-S NUMBER THEORY

5211.09
5212.09

(EXPERIMENTAL)

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida 33132
1971-72

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PREFACE

The following course of study has been designed to set a minimum standard for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher.

The course sequence is suggested as a guide; an individual teacher should feel free to rearrange the sequence whenever other alternatives seem more desirable. Since the course content represents a minimum, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

The second of four quins designed to develop computational skills with fractions, percents, and decimals using the "stretcher and shrinker" approach developed by the University of Illinois Committee on School Mathematics. Includes approximation, inverses, equations, factoring, and rearrangement.

Designed for the student who has successfully completed Introduction to Stretching Machines, 5211.08, 5212.08.

Table of Contents

	Page
Goals	3
Performance Objectives	3
Strategies	4
Time Schedule	6
Outline	
Approximations	7
Shrinking Machines	9
Hookups of Shrinking Machines	11
Mixed Hookups	12
Simplifying Long Mixed Hookups	14
Posttest	16
Suggested Sources of Activities	16

GOALS

1. To give the student positive, success-oriented experiences in math and increase his motivation

2. To develop and increase the student's understanding of and skill with the concepts of approximations, division hookups, inverses, equations, factoring and rearrangement

3. To increase the student's communication skills with computational concepts

PERFORMANCE OBJECTIVES

1. Identify equations in the form a . x = c, given a & b that have no solutions in the set of natural numbers.

2. Give the best approximation from to the set of natural numbers to equations as in 1. above.

3. Identify equivalent expressions involving stretching or shrinking division.

4. Solve simple equations involving stretching or shrinking.

5. Identify pairs of inverses.

6. Simplify hookups of stretchers and shrinkers by removing pairs of inverses.

7. Insert a pair of inverses to obtain an equivalent hookup.

STRATEGIES

Before beginning this quin, the teacher should read carefully the course description and comments contained in the Teacher's Edition and the Activities Handbook. In addition to these, the following general comments apply:

(1) Entering competencies required are: Mastery of Introduction to Stretching Machines 5211.08, 5212.08.

(2) In order to maintain student interest it is recommended that the teacher stick closely to the story line. A machine either stretches or shrinks, not multiplies or divides. The kids will realize the multiplier and divider properties of the machines and will verbalize this. You should acknowledge the correctness of this and then go on using machine terminology. One of the major benefits of this course is its novelty, don't destroy it.

(3) The heart of the course is found in the hundreds of activities found in the Activities Handbook, activities which foreshadow, expand, drill and supplement the development found in the text. The frequent and short quizzes found in that handbook help students to gain confidence, while at the same time reviewing small blocks of pages.

(4) It is practically impossible to use all the activities in the handbook. The activities are divided into required and optional. Plan to use all the required activities and those optional activities that are appropriate to your class and the time available.

(5) It is recommended that the overhead projector be used extensively. Many of the activities utilize transparencies, and transparencies of important workbook pages should be made to assist with discussion. Transparencies of quizzes and tests are valuable, so that students can either grade each other's paper or immediate feedback and discussion opportunities can be provided.

(6) The work text should be used primarily in a class-discussion approach, hopefully utilizing the overhead projector. Too much can be lost by simply working pages. The important ideas should be expanded and emphasized.

(continued)

(7) Discretion should be used in deciding whether or not to allow books to go home. It has been found effective to have row leaders distribute and collect books each day, leaving the books in the room. A beginning activity on the board can be used to expand on and review the material and to settle the students while the row leaders are distributing the books.

(8) The course was designed to be used in a work text type program. Much thought and planning should occur before utilizing the text as nonconsumable materials.

(9) Classroom supplies: Stretchers and Shrinkers

Assuming a class size of 30, the following supplies would be consumed by the class in one year. (4 quins: 5211.08/5212.08-5211.20/5212.20.)

30 - student sets (Book 1-4) of Stretchers and Shrinkers (if used consumably)
200 - index cards (3x5)
10 - reams of duplicator paper

The materials which follow may be used with several classes and should be saved from year to year:

1 - Teacher's Edition of Stretchers and Shrinkers
1 - Activities Handbook for Stretchers and Shrinkers
1 - meter stick
1 - yard stick
1 - box colored chalk
2 - boxes (100 sheets/box) thermal spirit masters
2 - boxes (100 sheets/box) transparency film for overhead projector
30 - scissors
30 - rulers (marked in inches and centimeters)
200 - file folders

You will also require the daily use of an overhead projector (with colored pens) and a file cabinet (at least three drawers).

STRETCHERS AND SHRINKERS

Time Schedule

Number Theory

	Chapter 1		
1-38	Approximations 2 Quizzes		10 days
	Chapter 2		
39-80	Shrinking Machines 2 Quizzes		10 days
	Chapter 3		
Hookups	Shrinking Machines 2 Quizzes	Test	7 days
	Chapter 4		
Mixed Hookups	2 Quizzes		8 days
	Chapter 5		
Simplifying Long Mixed Hookups	2 Quizzes	Test	6 days
			41

If you are able to stick to time schedule, you may utilize additional days for enrichment activities and computational review.

BOOK 2, CHAPTER 1: APPROXIMATIONS

TEXT PAGES	TOPIC	OBJECTIVE
1-4	Identifying stretching jobs that cannot be done exactly	Given a stretching job, the student can tell whether or not there is a machine that will do the job.
5-8	Bracketing cannot-do orders with consecutive stretchers	Given a stretching job, the student can tell the consecutive machines that bracket that job.
9-15	Find the machine that gives an output closest to that required	a. Given a cannot-do stretching job, the student can bracket it with consecutive machines.
15-23	Finding approximations: lower, upper, and best	b. Given a cannot-do job, the student can tell which machine is the best approximation, and give the error.
24-29	Using the error associated with the lower approximation to find the upper approximation	c. Given a cannot-do job where the lower and upper approximation errors are the same, the student knows that the upper approximation is the best approximation.
30-36	Using long division to find approximations	Given a cannot-do stretching job, and some division hints, the student can tell the lower approximation, the upper approximation, and their related error.

(BOOK 2, CHAPTER 1: APPROXIMATIONS)

TEXT PAGES	TOPIC	OBJECTIVE
37-38	Using best approximations in equations	Given an equation for a cannot do job, the student is able to supply the best approximation.

BOOK 2, CHAPTER 2: SHRINKING MACHINES

TEXT PAGES	TOPIC	OBJECTIVE
39-50	Using shrinking machines	a. Given a shrinking machine and an input, the student can give the output. b. Given a shrinking machine and an output length, the student is able to give the input. c. Given an input and an output for a shrinker, the student can tell what machine does the job.
51-53	Establishing notational conventions for input, shrinking machine, output relationships on history cards and output tags, and for solving equations	Objectives the same for pp. 39-50 except information is given in "history card" format or "equation" format, and limits on range of shrinkers is different.
54-55	Identifying equivalent jobs	Given a set of history cards describing jobs done, the student can identify equivalent jobs.
56-69	Applying stretching and shrinking to magnitudes other than length	Objectives the same as for pp. 39-50 except information is in magnitudes other than length and is also given in equation format.

(BOOK 2, CHAPTER 2: SHRINKING MACHINES)

TEXT PAGES	TOPIC	OBJECTIVE
60-75	Using conventional word names for shrinking jobs	The student is able to solve "practical" problems by stretching or shrinking when phrased in terms of "____ times" and "a ____th of".
76-80	Identifying pairs of inverses	a. Given the output of a stretcher or shrinker, the student can tell how to get back the original input. b. Given a machine or hook-up of stretchers, the student is able to tell what machine will undo the results of the original machine or hookup.

BOOK 2, CHAPTER 3: HOOKUPS OF SHRINKING MACHINES

TEXT PAGES	TOPIC	OBJECTIVE
81-89	Doing jobs with hookups of shrinking machines	a. Given a can-do hookup of shrinking machines with a missing input or output length, the student can supply it. b. Given input and output lengths for a can-do hookup of shrinkers with one machine not given, the student can supply it.
90-94	Factoring, shrinking machines	Given a composite shrinking machine, the student can factor it without using a I-machine.
95-99	Solving equations	Given a stretcher (shrinker) equation with a missing factor or product, the student can supply it.
100-106	Using punch cards to show shrinking jobs	a. Given stretching or shrinking jobs, the student can give a hookup of machines that will do the same job and express the results on a punch card. b. Given a punched card, the student is able to tell what job will be done.

BOOK 2, CHAPTER 4: MIXED HOOKUPS

TEXT PAGES	TOPIC	OBJECTIVE
107-116	Using both stretching and shrinking machines in the same hookup (Mixed hookups)	Given mixed hookups the student is able to supply missing inputs, outputs, or machines.
117-119	Deciding whether a mixed hookup does a stretching or a shrinking job	Given a mixed hookup, the student can tell whether it does stretching or shrinking jobs.
120-124	Doing jobs which require a mixed hookup	Given a job requiring a mixed hookup, the student can give at least one hookup which does it.
125-130	Deciding whether to use a mixed hookup or a single machine	Given a stretch or shrink job, the student can tell whether a single machine will do the job and give that machine, or if not, can give a mixed hookup to do the job.
131-132	Establishing and using notational conventions for mixed hookups on history cards and equations	Objective the same as for pp. 125-130 except data is given in history card or equation form.
133	Applying mixed hookups to magnitudes other than length	Objective the same as for pp. 125-130 except that magnitudes are other than length.

(BOOK 2, CHAPTER 4: MIXED HOOKUPS)

TEXT PAGES	TOPIC	OBJECTIVE
134-138	Stating the general rearrangement principle	Exploratory -- Given problems with mixed hookup, the student uses the general rearrangement principle to shortcut tedious computations.

BOOK 2, CHAPTER 5: SIMPLIFYING LONG MIXED HOOKUPS

TEXT PAGES	TOPIC	OBJECTIVE
139-143	Taking pairs of inverses out of hookups	Given a long mixed hookup, the student is able to recognize and eliminate inverses (no factoring necessary).
144-147	Rearranging and simplifying long mixed hookups to get short hookups	Given a long mixed hookup (no inverses), the student can give an equivalent hookup with a single stretcher and single shrinker.
148-151	Simplifying mixed hookups by first removing pairs of inverses	Given a long mixed hookup (with inverses), the student can give an equivalent short mixed hookup (no factoring necessary).
152-158	Removing pairs of hidden inverses	Given a mixed hookup, the student is able to factor, remove pairs of inverses, and simplify the result to an equivalent short mixed hookup in lowest terms, or a single stretcher or a single shrinker.

(BOOK 2, CHAPTER 5: SIMPLIFYING LONG MIXED HOOKUPS)

TEXT PAGES	TOPIC	OBJECTIVE
159-160	Inserting and hiding pairs of inverses in hookups	a. Given a short mixed hookup, the student can insert and hide a pair of inverses to get an equivalent short mixed hookup. b. Given a pair of short mixed hookups with a machine missing in one hookup, the student can tell what pair of inverses should be inserted to complete (if possible) the hookup so that it is equivalent to the other hookup.

PRETEST

The posttestfor 5211.08/5212.08 should serve as the pretest for this quin.

POSTTEST

Use Activity 127 (Test 3) and Activity 160 (Text 4) in the Activities Handbook as the posttest for this quin.

Suggested Sources of Enrichment and Practice Activities:

A. State adopted

1. Crouch, William H. Coordinated Cross Number Puzzles A, B, C. New York: McCormick-Mathers Publishing Co., 1970.

2. Denholm, R. A. and Blank, V. D. Mathematics Structure and Skills 1st Book. Chicago: Science Research Associates, 1968.

3. Foley, Jack; Jacobs, Wayne and Basten, Elizabeth. Individualizing Mathematics. Menlo Park, California: Addison Wesley Publishing Co., 1970.

   Skills and Patterns

   Whole Numbers
   Numbers-Patterns-Theory
   Sets
   Fractions--Addition and Subtraction
   Fractions--Multiplication and Division
   Decimals--Meanings and Operations

4. Johnson, D. A., et al. Activities in Mathematics: First Course: Number-Patterns. Glenview, Illinois: Scott, Foresman and Co., 1971.

5. Sobel, Max A., et al. Essentials of Mathematics Series: Book 1. Boston: Ginn and Company, 1970.

6. Tucker and Wheeler. Mathematics Laboratory. New York: McCormick-Mathers Publishing Co., 1970.

7. Wirtz, Robert W., et al. Math Workshop Levels C, D, E. Chicago: Encyclopedia Britannica Educational Corp., 1964.

B. Non-state adopted

1. Brandes, Louis G. Yes, Math Can be Fun. Portland, Maine: J. Weston Walch, 1960.

2. Dumas, Enoch. Arithmetic Games. Palo Alto, California: Fearon Publishers, Inc., 1960.

3. _____. A Collection of Cross Number Puzzles.

4. Larsen, Harold D. Games to Play.

5. _____. Guzintas.

6. _____. Ways to Multiply.

7. _____. Brain Teasers.

Evanston, Illinois: Harper and Row, Publishers, 1961.

8. Meyer, Jerome S. "Arithmetricks." Englewood Cliffs, N.J.: Scholastic Magazine, 1965.

9. Wagner, Guy, et al. Arithmetic Games and Activities. Darien, Connecticut: 1964.